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08/856,116	05/14/97	CHEN	F AMAT/1931

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EXAMINER

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ART UNIT	PAPER NUMBER
2814	11

DATE MAILED: 07/09/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

08/856,116

Applicant(s)

Fusen Chen et al.

Examiner

Bernard Souw

Group Art Unit

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☒ Responsive to communication(s) filed on Jun 23, 1999

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-21 is/are pending in the application.

Of the above, claim(s) 9, 10, and 19 is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-8, 11-18, 20, and 21 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☒ The drawing(s) filed on Jun 23, 1999 is/are objected to by the Examiner.

☒ The proposed drawing correction, filed on Jun 23, 1999 is ☐ approved ☒ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 2 and 7

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

1. The Amendment B filed on 06/23/99, Paper No.10B, in response to the first Office action mailed on 03/03/99 has been entered.

2. The present Office action is made with all the suggested amendments being fully considered. Claims 9 and 10 have been canceled by the Applicants, and a new claim 21 has been added.

The Examiner's restriction of claim 19 that has been previously traversed by Paper No.5 is now accepted by the Applicants without traverse. The restriction requirement is therefore made FINAL.

Accordingly, the pending claims being considered in this Office action are claims 1-8, 11-18, and 20-21.

3. Corrected or substitute drawings were received on 06/23/99, Paper No.10B. These drawings are Figs. 3, 4, 5, 10, 11, 12 and 17.

4. The proposed drawing corrections of Figs. 3, 10, 11, 12 and 17 submitted with Applicant's amendment in Paper No.10B are approved.

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5. The proposed drawing corrections of Figs. 4 and 5 submitted with Applicants' amendment in Paper No. 10B are objected, because the second barrier layer deposited on the bottom of the hole is not labeled as such (label 24).

Corrections are required.

6. Applicants' arguments filed on 06/23/99, Paper No. 10B, have been fully considered but they are not considered persuasive.

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1,5,15,18, and 20 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicants amendment of claims 1,5,15,18, and 20, i.e., substituting the original term, "hole", by a new term, "feature", is essentially introducing a new matter, since the substituted "feature" has a broader interpretation than the original "hole". Furthermore, the subject matter "feature" was not described in the specification. The specification, as well as Figs. 1-17, coherently and unambiguously show, that the "feature" recited in the amended claims is essentially no other than

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“(contact) hole”, such as, e.g., in the “Background of the Invention” on page 2/lines 8-12, in the recitations “ interconnected by *holes* penetrating”, and “ After the *holes* are etched, they are filled with a metal”.

The commonly accepted terminology for *a hole filled with metal* is a *plug*, as further recited by the Applicant on page 2/lines 12-13, “The generic structure is referred to as a *plug*. If the *plug* is connected to silicon or polysilicon, the *plug* is a contact. If the *plug* is connected to a metal, the *plug* is a via”. Thus, a *plug* is per Applicant’s own definition no other than *a hole filled with metal*. This is also obvious in the “Summary of Invention” on page 4, line 8, when the Applicants recite “... forming a *hole* through the barrier layer and the dielectric layer, depositing a generally conformal second barrier layer in the *hole*, removing the barrier layer from the bottom of the *hole*, and selectively filling the *hole* with copper”.

However, the Applicants confuse themselves by using the term “*plug*” instead of “*hole*” on page 7 lines 1 and lines 4-5, reciting “... etched to form a plug 20 through the barrier layers ...”, and “ ... layer formed *on the bottom of the plug* 20 at the”, and further, “... Cu can be selectively grown *in the plug* ...”. In those passages the Applicants are using the word “plug” inconsistently with the accepted meaning. The Merriam Webster’s Collegiate Dictionary (10th edition, page 895), e.g., defines a plug as “a piece used to fill a hole”, thus to be distinguished from the *hole* itself.

While applicant may be his or her own lexicographer, a term in a claim may not be given a meaning repugnant to the usual meaning of that term. See *In re Hill*, 161 F.2d 367, 73 USPQ 482 (CCPA 1947). The term “plug” in the recited lines of the disclosure is used by the Applicants to

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mean "hole," while the accepted meaning is "a piece used to fill a hole". Consequently, the generic term "feature" can not be used in claims 1, 5, 15, 18, and 20 to substitute for the words "hole", nor "plug", nor both, without broadening the original and individual meanings of "hole" and "plug".

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-8, and 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taguchi et al. in view of Ho et al., and further in view of Barnes et al. and Bunshah.

Applicants' amendment, i.e., changing the term "(contact) *hole*" into "*feature*", does not lend any patentability to the claims, because the specification, as well as Figs. 1-17, coherently and unambiguously show, that the "feature" recited in the amended claims is essentially no other than "contact hole" (see 35 USC 112 ¶ 1 above).

(8a). Claim 1, previously rejected under 35 USC 102(b) for being clearly anticipated by Taguchi et al. in Paper No.4, has been amended by incorporating claim 9 and claim 10. Claim 9 has been previously rejected under 35 USC 103(a) for being obvious over Taguchi et al. in view of Ho et al., whereas claim 10 has been previously rejected under 35 U.S.C. 103(a) for being obvious over Taguchi et al. in view of Ho et al., and further in view of Barnes et al. and Bunshah. Consequently,

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without adding new ground of rejection, claim 1 is now rejected under 35 USC 103(a) as being unpatentable over Taguchi et al. in view of Ho et al., and further in view of Barnes et al. and Bunshah, for precisely the *same reasons as applied previously* to claims 1, 9, and 10. As previously applied to claim 10, Ho's layer (40) in Fig. 1g is copper, as disclosed in Col.7/ll.30-40. Furthermore, as previously applied to claim 9, Ho's barrier layer (24) in Fig 1a, as well as respective barrier layers in all other figures, is made of tantalum, as specifically recited in Col.10/l.44.

Since (a) the amended claim 1 fails to prove patentability over previously applied reasons, and (b) the present change of ground for rejection, from 35 USC 102(b) to 103(a), is solely necessitated by the way claim 1 is amended by the Applicants without introducing any new reason and/or prior art, the present 35 USC 103(a) rejection of claim 1 is considered FINAL.

(8b) The limitations of claims 2-4 and 8 remain obvious over Taguchi et al., as applied previously, whereby the secondary prior arts of Ho et al., Barnes et al., and Bunshah applied to the present 35 USC 103(a) rejections are included solely to obviate the limitations of the amended parent/base claim 1 that have originated from the unamended claims 9 and 10.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

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In particular, Applicants' argument that Taguchi et al., while describing a combination of a Si_xN_y layer, a titanium layer, and an aluminum layer, does not suggest replacement of the TiN barrier layer by Ta layer as claimed by Applicants, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

In this particular case, the secondary reference of Ho et al. uses Ta as barrier layer, just as claimed by the Applicants.

The same Examiner's comment is here applicable to Applicants' further argument, that Ho et al., while disclosing the step of filling aperture with copper, do not suggest the steps of depositing and etching Si_xN_y layers. In this case the steps of depositing and etching Si_xN_y layers are taught by Taguchi et al.

Regarding Applicants' general argument, that the remaining references generally relate to depositing copper layers, but without mentioning Si_xN_y layer, again, Si_xN_y layer is comprised in Taguchi's method.

(8c). Claims 5 and 6 remain obvious over Taguchi et al. in view of Ho et al., as applied previously in Paper No.4, whereby the secondary prior arts of Barnes et al., and Bunshah are included in the

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present 35 USC 103(a) rejections solely to obviate the limitations of the amended parent/base claim 1 that have originated from the unamended claims 9 and 10..

(8d). Claim 7, previously obvious under 35 USC 103(a) over Taguchi et al. in view of Barnes et al. in Paper no.4, is now obvious over Taguchi et al. in view of Ho et al., and further in view of Barnes et al. and Bunshah, as a consequence of the above rejections of the amended claims 1 and 5, without introducing any new reasons and/or prior art.

(8e). Claims 11 and 12 remain obvious under 35 USC 103(a) over Taguchi et al. in view of Ho et al., and further in view of Barnes et al. and Bunshah, as previously applied in Paper No.4, without introducing new reasons and/or prior arts.

The 35 USC 103(a) rejections of claims 11 and 12 are therefore considered FINAL.

(8f). Claims 13 and 14 are now rejected under 35 USC 103(a) as being obvious over Taguchi et al. in view of Ho et al., and further in view of Barnes et al. and Bunshah.

The change of ground for rejection from 35 USC 102(b) to 103(a) has been necessitated solely by the way claim 1 has been amended by the Applicants, whereby the secondary prior arts of Ho et al., Barnes et al. and Bunshah are included in the present 35 USC 103(a) rejections solely to obviate the limitations of the amended parent/base claim 1 that have originated from the unamended claims 9 and 10.

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In addition, Applicants' argument in Paper No.10B provides another reason for rejection. Applicants admit in Paper No.10B, page 6, lines 18-19, that the limitations of claims 13 and 14 are well known to a person skilled in the art. Consequently, the said claims are now additionally, and even more strongly, rejected under the very reason as stated by the Applicants in their own argument, i.e., as being methods already known to a person skilled in the pertinent art. Being neither inventive nor a novelty, the claimed invention as represented in claims 13 and 14 is not patentable.

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 15-18 and 20 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Taguchi et al., as applied previously in Paper No.4.

Applicants' amendment, i.e., changing the term "(contact) *hole*" into "*feature*", does not lend any patentability to the claims, because the specification as well as Figs. 1-17, coherently and unambiguously show, that the "*feature*" recited in the amended claims is essentially no other than "contact hole" (see 35 USC 112 ¶ 1 above).

Applicants traverse the rejection by amending the claims, such that they now include the novelty of etching the Si_xN_y layer to expose an underlayer within a *feature* [contact hole], and depositing a metal layer on the underlayer to fill the *feature* [hole]. The Applicants set forth, that the

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step of depositing the metal layer directly on the underlayer is contrary to the teaching of Taguchi et al. (Amendment B, page 6 lines 3-4 from bottom). However, in total contradiction to Applicants' arguments, Taguchi's layer (20a) in Fig.9 clearly shows an exposed underlayer after the Si_xN_y layer is etched, and Taguchi's layer (23) in Fig.10 clearly shows the metal layer being newly deposited on the bottom of the *feature* [hole].

10. Claim 21 newly added in Paper No. 10B (Amendment B) is rejected under 35 U.S.C. 103(a) as being unpatentable over Taguchi et al. in view of Ho et al., and further in view of Barnes et al. and Bunshah.

Taguchi et al. shows all the limitations of claim 21, as applied above to the parent/base claim 15, except the step of using copper as metal layer in the parent base claim 15, substep (e).

As recited previously in the rejection of claim 1, Ho's metal layer is copper.

In the instant case, one cannot show nonobviousness by attacking references individually, where 35 U.S.C. 103(a) rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

11. In response to Applicants' general argument not specifically addressed to any particular claim (Paper No.10B, page 6, line 2), namely that Barnes et al. and Bunshah, too, do NOT disclose ALL features of the claimed invention, including sputtering of tantalum and copper with high density

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plasma, the Applicants are generally reminded, that one cannot show nonobviousness by attacking references individually, where 35 U.S.C. 103(a) rejections are based on combinations of references.

In particular, a recitation of the intended use of the claimed invention, in this case the method of sputtering for use in depositing tantalum and copper with high density plasma, must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior arts, i.e., Barnes et al. and Bunshah. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963).

Such a manipulative difference in the method is completely absent in the claims, nor is such difference ever recited throughout the entire disclosure. Thus, claims reciting a general method of depositing materials well-known to a person skilled in the art are principally not patentable if they depend on a rejected parent/base claim. If they depend on an allowable base claim, those claims can be allowable because they include the limitations of the allowed base claim.

As specifically recited in Paper No.4 with regard to the previous rejection of claim 7, Barnes' sputtering method essentially belongs to the category of PVD methods, the latter being well known to every person in the art (see, e.g., the definition and classification of the PVD method in Bunshah's Handbook, Table 9.1 on page 461).

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12. **THIS ACTION IS MADE FINAL.** Applicants are reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

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Papers related to this application may be submitted directly to Art Unit 2814 by facsimile transmission. Papers should be faxed to Art Unit 2814 via the Technology Center 2800 fax center located in Crystal Plaza 4, room 4C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (15 November 1989).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E. Souw whose telephone number is (703) 305-3303. The examiner can normally be reached on Monday-Friday from 8:30 am to 5:00 pm.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudury, can be reached on (703) 306-2794. The fax number for the organization where this application or proceeding is assigned is (703) 308-7722 or -7724.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center receptionist at (703) 308-0956.

BES

Bernard E. Souw

June 02, 1999


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